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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/033,854
Filing Date: December 19, 2001
Appellant(s): SAMBASIVAM ET AL.

Robert G. Winkle
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed August 20th, 2004.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief included a statement that for the purposes of this appeal: Claims 1-20 stand or fall together.

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

The Applicant's Admitted Prior Art (AAPA) contained in the specification of this Application.

US 5,766,982	Akram et al.	06-1998
US 6,242,798	Cha et al.	06-2001

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-20 are rejected under 3 5 U.S. C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (AAPA) in combination with Akram et al. (U.S. Patent No. 5,766,982) and Cha et al. (U.S. Patent No. 6,242,798).

AAPA discloses in figures 12-18 and related text of the specification a method of fabricating a microelectric package comprising providing a substrate (figure 12: 204) having a first surface (figure 12: 214), and opposing second surface, and a plurality of lands (figure 12: 212) disposed on the first surface; providing a microelectronic die (figure 12: 202) having an active surface (figure 12: 208), a back surface, and a plurality of pads (figure 12: 206) disposed on the active surface in a corresponding relationship to the plurality of substrate lands; electrically attaching the plurality of substrate lands to the plurality of corresponding microelectronic die pads with a plurality of conductive bumps (figure 12: 216); disposing an underfill material (figure 13: 222) such that the underfill material is dispersed between the microelectronic die active surface and the substrate first

surface wherein the underfill material is dispensed by a needle (figure 13, 230) and the underfill material comprises an epoxy material (page 3, line 6) and is cured (page 3, line 10).

AAPA also discloses providing a second micorelectronic die (figure 17: 242) having an active surface (figure 17: 256), a back surface (figure 17: 244) and at least one wirebond pad (figure 17: 254) disposed on the active surface, attaching the second microelectronic die back surface to the microelectronic die back surface (figure 17) and attaching at least one wirebond (figure 17: 252) between the at least one substrate wirebond land (figure 17: 258) and the second microelectronic wirebond pad, wherein attaching the second microelectronic die back surface to the microelectronic die back surface comprises disposing a layer of adhesive therebetween (page 4, line 5).

AAPA fails to disclose forming a through hole extending from the substrate first surface to the substrate second surface and disposing the underfill material through the through hole.

Akram, however, discloses in (col. 6, line 34 to col. 7, line 30 and figures 5-7) a method of fabricating a microelectric package comprising providing a substrate (figure 5: 10) having a first surface (figure 5: 18), an opposing second surface; forming a through-hole (figure 5: 60) extending from the substrate first surface to the substrate second surface; providing a microelectronic die (figure 5: 12) having an active surface (figure 5: 20), a back surface, and a plurality of pads (figure 5: 22) disposed on the active surface in a corresponding relationship to the plurality of substrate lands; electrically attaching the plurality of substrate lands to the plurality of corresponding microelectronic die pads with

a plurality of conductive bumps (figure 5: 24); and disposing an underfill material (figure 5: 28) through the through-hole such that the underfill material is dispersed by capillary action (col. 1, lines 46-58 and FIG. 5) between the microelectronic die active surface and the substrate first surface wherein the underfill material is dispensed by a dispensing needle (figure 5: 34) and the underfill material comprises an epoxy material (col. 1, lines 46-58) and is cured (col. 7, lines 16-30). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the teachings of Akram with the method of AAPA in order to prevent the underfill material from spreading beyond the sidewalls of the semiconductor device (col. 3, lines 2-3, Akram).

Neither AAPA nor Akram disclose positioning the microelectronic die and the substrate such that the microelectronic die is gravitationally below the substrate.

Cha et al., however, discloses that epoxy can be applied from the top down through a through hole instead of injected upward (figure 5B and col. 4, lines 5-20). It would have been obvious to one of ordinary skill at the time of the invention was made to combine the teachings of Cha with the combined method AAPA and Akram in order to provide a reduced processing time and decreased solder fatigue (col. 2, lines 30-40, Cha).

(11) No new grounds of rejection

This examiner's answer does not contain any new grounds of rejection.

(12) Response to Argument

I (Issue): Does Applicant's Admitted Prior Art (AAPA) in combine with Akram et al. teaches or suggest disposing an underfill material through the through-hole such that the underfill material is dispersed by capillary action between the microelectronics die active surface and the substrate first surface?

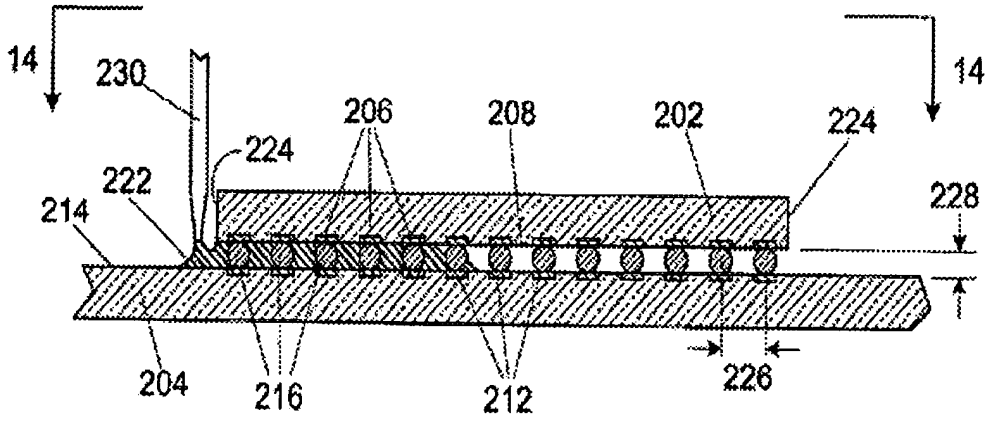
R (Rule): ***35 USC § 103 (a)***

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

A (Analysis): Appellants argue that the Akram patent neither teaches nor suggest disposing an underfill material through the through-hole such that the underfill material is dispersed by capillary action between the microelectronics die active surface and the substrate first surface. Respondent respectfully disagrees, as the Examiner cited in the Final Rejection, page 2, 1st paragraph, stated in AAPA, (Specification, page 3, lines 3-11 and figure 13).

> To enhance the reliability of the solder bumps 216 connecting the microelectronic die pads 206 and the substrate lands 212, an underfill material is used to mechanically and physically reinforce them. In a known method of underfill encapsulation shown in FIGs. 13 and 14, a low viscosity underfill material 222, such as an epoxy material, is dispensed from at least one dispensing needle 230 along at least one edge 224 (usually one or two edges) of the microelectronic die 202. The underfill material 222 is drawn between the microelectronic die 202 and the substrate 204 by capillary action (in generally the x-direction shown as arrows 240 in FIG. 14), and the underfill material 222 is subsequently cured (hardened) using heat, which forms the microelectronic package 200 shown in FIG. 15.

FIG. 13
Prior Art



AAPA discloses disposing an underfill material 222 using dispensing needle 230 along edges 224 such that the underfill material is dispersed by capillary action between the microelectronic die 202 active surface 208 and the substrate 204 first surface 214.

Although, AAPA does not explicitly teach or suggest disposing the underfill material through the through-hole as cited in the Appellants' claimed limitation. As the Examiner cited in the Final Rejection, pages 3-4, 2nd paragraph, stated in Akram, (col. 6, lines 34-48 and FIG. 5).

Referring to FIG. 5, a cross-sectional view of an interconnected solder-bumped 24 flip-chip 12 and substrate 10 of a fifth embodiment of the present invention is shown midway through the underfill process. In this particular embodiment, the substrate 10 has a suitable shaped opening 60 situated near the center of the substrate 10 through which underfill material 28 can be applied via the underfill dispenser 34. Additionally, dams 40 and 40' located on each side of the flip-chip 12 are molded or suitably attached to top surface 18 of the substrate 10 as described hereinbefore being positioned to lay slightly beyond first and second sidewalls, rear sidewall 32, and front sidewall 30, respectively. It should also be understood that other dams 40' (not shown) are located on the first and second lateral sidewalls of the flip-chip 12 to confine the underfill.

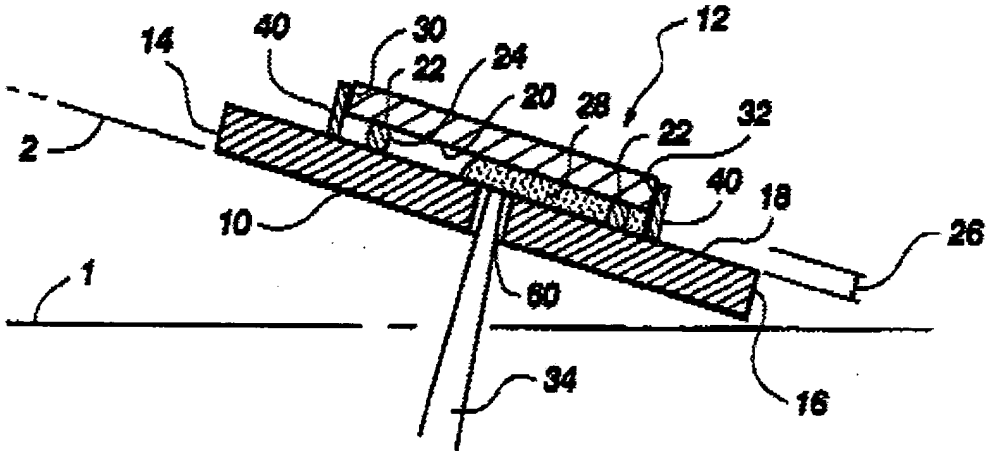


Fig. 5

Akram discloses disposing an underfill material 28 using an underfill dispenser 34 through the opening (through-hole) 60 such that the underfill material is dispersed by capillary action between the microelectronic die 12 active surface 22 and the substrate 10

first surface 18. Although Akram does not explicitly mention that the underfill material is dispersed by capillary action in the above cited paragraph. Akram provides evidence in another paragraph (col. 1, lines 46-58, Akram) that the process of dispensing the underfill material into the gap between the flip chip and the substrate by capillary action is known.

> In practice, the underfill material is typically dispensed into the gap between the flip-chip and the substrate by injecting the underfill along two or more sides of the flip-chip with the underfill material flowing, usually by capillary action, to fill the gap. For example, U.S. Pat. No. 5,218,234 to Thompson et al. discloses a semiconductor device assembly whereby an epoxy underfill is accomplished by applying the epoxy around the perimeter of the flip-chip mounted on the substrate and allowing the epoxy to flow underneath the chip. Alternatively, the underfill can be accomplished by backfilling the gap between the flip-chip and the substrate through a hole in the substrate beneath the chip.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the teachings of Akram with the method of AAPA in order to prevent the underfill material from spreading beyond the sidewalls of the semiconductor device (col. 3, lines 2-3, Akram).

C (Conclusion): The Applicant's Admitted Prior Art (AAPA) in combination with Akram et al. discloses disposing an underfill material through the through-hole such that the underfill material is dispersed by capillary action between the microelectronics die active surface and the substrate first surface.

(13) Conferees

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Khiemnguyen

Respectfully submitted,

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November 12th, 2004

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PRIMARY EXAMINER